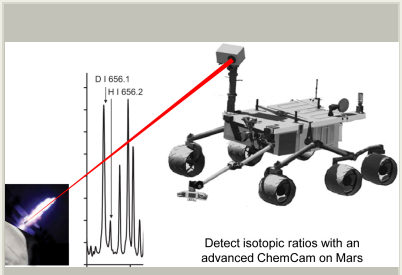
ChemCam-like Spectrometer for Non-Contact Measurements of Key Isotopes, Phase II

Completed Technology Project (2014 - 2016)

Project Introduction

This project addresses the need for a non-contact instrument capable of measuring the isotopic ratios O-18/O-16 and D/H from water ice and other solid materials (rocks). Frozen H2O is the dominant ice in the outer solar system, recently found on the Moon. Extensive deposits of near-surface ice discovered on Mars. Oxygen and hydrogen isotopic records preserve history of water/rock interactions depending on chemistry and ambient conditions. Ratios of these isotopes are the main tool in paleoclimatology studies on Earth. A proposed non-contact optical instrument similar to ChemCam will be capable of measuring not only complete elemental compositions but also the key isotopic abundances in surface materials. We demonstrated the resolution and sensitivity required to determine these isotopes in synthetic samples and natural minerals relevant to Mars. We are utilizing and developing our recently published technology: Laser Ablation Molecular Isotopic Spectrometry (LAMIS). Our concept is simple and scientifically proven. We will advance to TRL4 with the further aim of integrating our LAMIS detector with a ChemCam-like instrument. The proposed effort leverages and advances the technology developed for ChemCam. The added strength of measuring isotopes will greatly expand the capabilities of the ChemCam, which is already a highly successful instrument onboard "Curiosity". We will develop a breadboard prototype of the instrument that can be later amended to measure other key isotopes (C, N, B, Cl, Mg, Ca, Sr). We plan further infusion in NASA missions and commercialization. The immediate focus is on Mars but our concept is also highly germane to future landing missions to the Moon, other planets and their moons, asteroids, and to a broad range of applications in ecology, agronomy, nuclear industry, radio-chemotherapy, forensics, security and other fields. Our instrument can be used for stand-alone landing missions or for in situ sample characterization prior to sample return.



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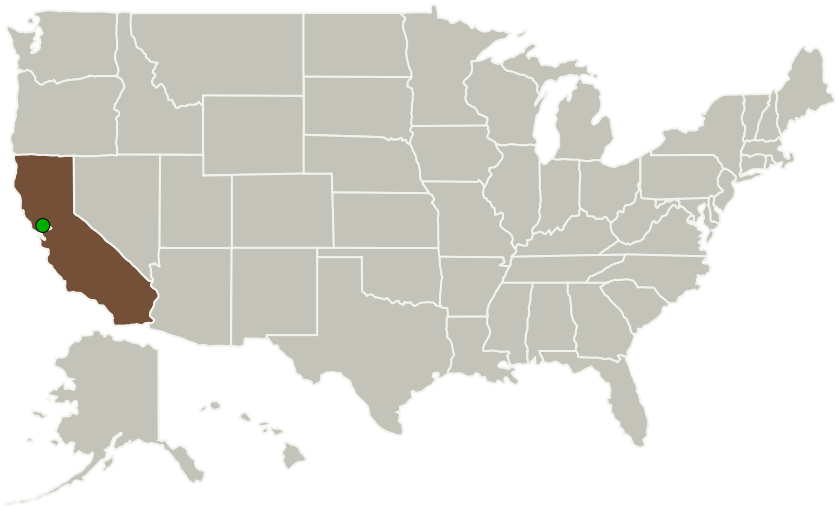
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Applied Spectra, Inc.	Lead Organization	Industry	Fremont, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

April 2014: Project Start

April 2016: Closed out

Closeout Summary: ChemCam-like Spectrometer for Non-Contact Measurements of Key Isotopes, Phase II Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/137458)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Applied Spectra, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Alexander A Bolshakov

Co-Investigator:

Alexander Bolshakov

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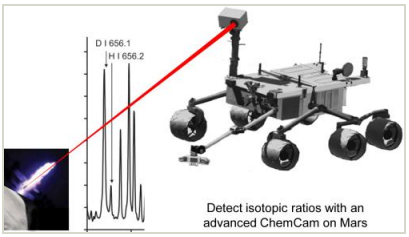
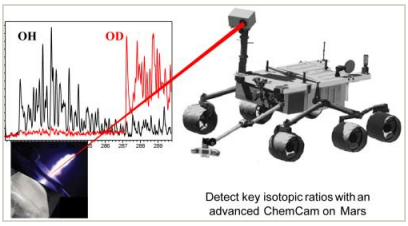
Images



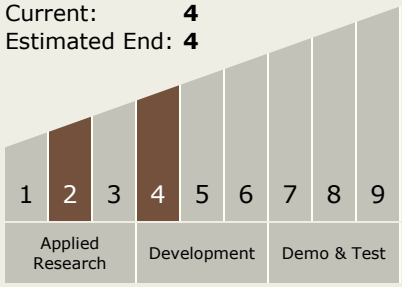
Briefing Chart Image
ChemCam-like Spectrometer for Non-Contact Measurements of Key Isotopes, Phase II
(https://techport.nasa.gov/image/136627)



Final Summary Chart Image
ChemCam-like Spectrometer for Non-Contact Measurements of Key Isotopes, Phase II Project Image
(https://techport.nasa.gov/image/135403)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System